BEFORE THE

INDIANA UTILITY REGULATORY COMMISSION

SOUTHERN INDIANA GAS AND	**)**	
ELECTRIC COMPANY	**)**	
d/b/a VECTREN ENERGY	**)**	**CAUSE NO. 43839**
DELIVERY OF INDIANA, INC.	**)**	
(VECTREN SOUTH - ELECTRIC)	**)**	

DIRECT TESTIMONY

OF

DR. EMMA L. NICHOLSON - PUBLIC'S EXHIBIT NO. 12

ON BEHALF OF THE

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

JUNE 25, 2010

EXETER
ASSOCIATES, INC.
10480 Little Patuxent Parkway
Suite 300
Columbia, Maryland 21044

TESTIMONY OF DR. EMMA L. NICHOLSON
CAUSE NO. 43839
VECTREN SOUTH-ELECTRIC

Q. Please state your name, occupation and address.

A. My name is Emma L. Nicholson. I am a senior economist with Exeter Associates, Inc. Our offices are located at 10480 Little Patuxent Parkway, Suite 300, Columbia, Maryland 21044.

Q. Dr. Nicholson, please summarize your professional qualifications.

A. I hold a B.S. degree in Economics and Government and Politics from the University of Maryland at College Park. I hold an M.A. and Ph.D. in Economics from Georgetown University. Prior to joining Exeter, I served as a senior consultant in Bates White, LLC's energy practice. I also worked at the Federal Energy Regulatory Commission for three summers while in graduate school. Before attending graduate school, I was a research associate at Exeter Associates, Inc. A copy of my resume is provided as an attachment to my testimony.

I. Introduction

Q. What is the purpose of your testimony?

A. The first purpose of my testimony, filed on behalf of the Indiana Office of Utility Consumer Counselor (OUCC), is to summarize the changes I made to the class cost-of-service study (COS) filed by Vectren Energy Delivery of Indiana, Inc. ("Vectren South" or "the Company") as directed by my associate Dr. Dale Swan. Specifically, I reran the Company's COS study to produce a Peak and Average (P&A) version and a 12 Coincident Peak (12-CP) version. The second purpose of my testimony is to provide my analysis of the Company's application of the Zero Intercept model, which was used by the Company to classify line transformers (Account 368) as partly demand-related and party customer-related.

Q. Do you provide a schedule in support of your testimony?

A. Yes. I have attached Schedule ELN-1 to my testimony.

Q. Was this schedule prepared by you?

A. Yes.

II. <u>Producing the OUCC P&A and 12-CP Cost-of-Service Studies</u>

Q. Please briefly describe the changes you made to the Company's cost of service model to produce the OUCC Peak and Average cost-of-service study.

A. The Company provided its COS study in Excel format which enabled me to make changes to that study. I first reviewed the Company's study to gain a full understanding of the operation of the spreadsheet architecture. Once I understood the model, I made the changes that Dr. Swan requested based on his review of Mr. Kerry A. Heid's testimony and the Company's COS study.

Q. Please summarize the changes that you made to the Company's cost-of-service study to produce the OUCC's P&A study.

A. Dr. Swan instructed me to make the following changes:

1. Create a P&A allocator that assigns a 55 percent weight to class energy usage at generation and a 45 percent weight to each class' contribution to the average of the four highest monthly coincident peak demands (4-CP).
2. Substitute the P&A allocator for the 4-CP allocator in the Company's COS model except for "Interruptible Credits" in Miscellaneous Revenues.
3. Allocate all secondary distribution costs on class non-coincident peak (NCP) demands at secondary.
4. Allocate "Uncollectible Accounts" on "*pro forma* Normal Revenues without Miscellaneous Revenues" (allocator 6 in the Company's COS model).
5. Allocate "Customer Service and Information Expenses" on Energy at Meter.

The Company's COS model did not include an allocator for Energy at Meter so I created a new allocator. I used "Total Sales at Meter – kWh" as the basis for the "Energy at Meter" allocator, which was available on the "Sales by Voltage Level" tab (line 1) of the Company's COS model.

Q. Please briefly describe the changes you made to the Company's cost-of-service model to produce the OUCC 12-CP cost-of-service study.

Pursuant to Dr. Swan's request, I produced an alternative COS study for the OUCC that relies on the 12-CP allocator rather than on the P&A allocator. This COS study was produced by substituting the 12-CP allocator for the P&A allocator where the P&A allocator appears in the OUCC's P&A study.

III. Review of the Company's Application of the Zero Intercept Model

Q. What is the Zero Intercept model and what does it aim to accomplish?

A. The Zero Intercept model attempts to estimate the customer component of distribution plant costs (Accounts 364-368).[1] Vectren South witness Mr. Heid used the Zero Intercept model to classify line transformers (Account 368) as both customer-related and demand-related. Mr. Heid allocated the demand-related portion of the cost of line transformers on class NCP demands and the customer-related portion on the number of customers in each class. (See Petitioner's Exhibit No. KAH-1, page 7.)

Q. How does the Zero Intercept model classify distribution plant costs to customer- and demand-related components?

A. The Zero Intercept model assumes that it is possible to determine the proportion of distribution plant costs that are directly attributable to the number of customers served by calculating the cost of a hypothetical system that carries no load. This hypothetical system simply connects customers to the system but does not deliver electricity. The

[1] "Electric Utility Cost Allocation Manual," National Association of Regulatory Utility Commissioners, January 1992.

ratio of the cost of the hypothetical system and the cost of the actual system is assumed to equal the proportion of the distribution plant costs that depend on the number of customers.

When applied to line transformers, the model posits that the cost (expressed in dollars) of a given line transformer is dependent upon a constant term and the size of the transformer (expressed in KVA). This relationship is presented in equation (1) below:

$$\text{transformer cost} = \text{constant} + \beta^*(\text{transformer size in KVA}) \qquad (1)$$

The constant and β parameters are estimated with an ordinary least squares (OLS) regression. The parameter of interest in the Zero Intercept model is the constant, or "zero-intercept," because it purportedly represents the cost of a transformer of size zero (i.e., {transformer cost with KVA=0} = constant + (β*0) = constant).

Q. How does the Zero Intercept model estimate the parameters of interest?

A. The true values of the constant and β are unknown, but they can be estimated. An OLS regression is a statistical technique that estimates the relationship between two or more variables with a linear equation in such a way that minimizes the sum of squared errors.[2] In the OLS framework, a "dependent" variable is modeled as a linear function of one or more "independent" variables. In the Zero Intercept model, the dependent variable is transformer cost and the independent variables are the constant and transformer size. Regression analysis is a highly developed statistical technique

[2] An OLS regression takes the form: $y_i = X_i\beta + \varepsilon_i$, for i=1,…,n observations where y is the dependent variable, X is a matrix of independent variables, β is a vector of parameters, and the ε_is are independent draws from a random variable with mean zero and variance σ^2. The sum of squared errors is the sum of the difference between the actual observation (y) and the OLS prediction for that observation ($\hat{y}$). The sum of squared errors in an OLS regression is calculated as follows: $\sum_{i=1}^{n}(y-\hat{y})^2$.

and an extensive body of literature exists on how to perform regressions and evaluate their results.

Q. Are the results of all OLS regressions valid and reliable?

A. No. An OLS regression can produce unreliable and/or misleading results. Given this shortcoming, several diagnostic tests have been developed that allow the practitioner to evaluate whether the OLS regression results are valid. It is important to review and evaluate these diagnostics before accepting the results of an OLS regression.

Q. What diagnostics should be reviewed to evaluate the results of an OLS regression?

A. One common diagnostic of an OLS regression is the "R-squared" statistic. This statistic reports the proportion of the variation in the dependent variable that is explained by the independent variables. While the R-squared is an important statistic that gives a measure of the overall "goodness of fit," it is by no means the only relevant diagnostic. Indeed, many researchers place more weight on other diagnostics because the R-squared can be artificially increased by adding additional, though not necessarily relevant, variables.[3] Other equally important characteristics include the number of observations included in the regression, and the standard errors, t-statistics, and 95 percent confidence bounds of the parameter estimates.

Q. Why is the sample size of an OLS Regression important and what is the minimum acceptable sample size?

A. The number of observations used to estimate a regression is important because the larger the sample size, the more precise the parameter estimates will be.[4] On an intuitive level, if you want to conduct an opinion poll of a certain population, the larger the number of people polled within that population, the more likely the poll

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[3] Green. R. "Econometric Analysis, Fourth Edition". (2000) pp. 239-240.
[4] Green, R. Econometric Analysis. *Fourth ed.* Prentice Hall, NJ: 2000, pp. 350-354.

result will reflect the average opinion of the population as a whole. While there is no universally agreed upon minimum sample size, I have seen estimates range from 30 to 50 observations.[5]

Q. What other diagnostics are important?

A. Other equally important OLS regression diagnostics include the standard errors, t-statistics and confidence bounds of the parameter estimates themselves. The standard errors are used to calculate the t-statistics and confidence bounds. A t-statistic is a diagnostic that is used to perform a t-test to determine whether the parameter estimate is statistically different from zero; this is also known as a test of "statistical significance." Confidence bounds provide a range of values in which the true parameter value is likely to fall.

Q. What is statistical significance?

A. A parameter estimate is statistically significant if a t-test suggests that the independent variable associated with that parameter has an effect on the dependent variable. The t-test is the most common test performed on parameter estimates and tests the hypothesis (referred to as the null hypothesis) that the true parameter is equal to zero. If the t-test fails to reject the null hypothesis that the true parameter equals zero, that parameter is regarded as statistically insignificant. The larger the standard error, the smaller the probability that the parameter estimate will be statistically significant.

Q. What are 95 percent confidence bounds?

A. The 95 percent confidence bounds give a range of values within which the underlying parameter value (i.e., the true value of the parameter the OLS regression is

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[5] R. Hill, W. Griffiths, and G. Judge. Undergraduate Economics. *Second ed.* John Wiley & Sons, Inc. USA: 1997, p. 80.

estimating) will likely fall. The 95 percent confidence bounds will contain the true parameter value 95 percent of the time.[6] The larger a parameter estimate's standard error, the larger its 95 percent confidence interval.

Q. Are there other important properties of OLS parameter estimates?

A. Yes. In addition to statistical significance and a reasonably narrow confidence bound, parameter estimates should be robust. By robust, I mean that the estimates should be relatively stable and not change substantially when additional observations are added to, or removed from, the original OLS regression sample. If a parameter estimate is not robust, then it is not reliable.

Q. How did Mr. Heid construct the sample that he used to estimate the OLS regression that underlies his Zero Intercept study?

A. Mr. Heid estimated equation (1) on five observations based on single-phase line transformers in the following five size categories:[7]

1. 3-19 KVA
2. 20-50 KVA
3. 51-150 KVA
4. 151-200 KVA
5. 201-350 KVA

Mr. Heid developed the independent variable – transformer size – by assigning a single size (in KVA) to all of the transformers within each size category. The assumed size was equal to the average of the sizes that define the category (i.e., the "size" of all single-phase transformers in the 51-150 KVA category is (51+150)/2 = 100.5 KVA). I describe Mr. Heid's transformer size assumptions in more detail later in my testimony. Mr. Heid next developed the dependent variable,

[6] Based on repeated sampling, confidence bounds will contain the true parameter 95 percent of the time. Confidence bounds can be based on various percentage levels but 95 percent is the most common width.

[7] *See* Kerry A. Heid's Zero Intercept study workpapers, MSFR 15ab, p. 90.

the average cost of the transformers in each size category, by dividing the total cost of the transformers in each category by the number of transformers in that category.

Q. What are Mr. Heid's OLS parameter estimates?

A. Mr. Heid's parameter estimates are as follows:

Table 1: K. Heid's Zero Intercept Study Results	
Constant/zero-intercept estimate	$400.1129
β estimate	$10.4566

Source: Kerry A. Heid workpapers, MSFR 15ab, p.90

Mr. Heid's workpapers show that the R-squared of the OLS regression is equal to 0.9957. However, the workpapers did not contain any other diagnostics, such as the standard errors, t-statistics, or 95 percent confidence bounds of the parameter estimates.

Q. How did Mr. Heid use his Zero Intercept results to estimate the customer- and demand-related components of line transformer costs?

A. Mr. Heid multiplied his zero-intercept estimate by the total number of Vectren South's 55,487 transformers and capacitors to determine the "customer component" of line transformers (i.e., $400.1129 x 55,487 = $22,201,179). The total cost of line transformers is $59,508,568, and $22,201,179 constitutes 37.31 percent of this total. Hence, Mr. Heid concluded that 37.31 percent of line transformer costs should be allocated to the customer classes on the basis of customer numbers. Mr. Heid allocated the balance (62.69 percent) of line transformer costs on NCP demands at secondary.

Q. Were you able to replicate Mr. Heid's results?

A. Yes. I also calculated additional diagnostic statistics that Mr. Heid did not produce and presumably did not rely upon in evaluating the results of his Zero Intercept study.

I calculated the standard errors, t-tests for statistical significance, and confidence bounds. I found that Mr. Heid's parameter estimates are statistically significant but as I explain later, the sample size is too small to produce valid OLS results.

Q. Based on your calculations, review, and evaluation of these diagnostics, do you believe the results obtained by Mr. Heid are reliable?

A. No, I do not. The results of Mr. Heid's Zero Intercept study are not reliable because they are based on an insufficient sample size. An OLS regression should include approximately 30 observations; otherwise the results are not credible.[8] On that basis alone, the Company's Zero Intercept study should not be used to classify line transformer costs as customer- and demand-related. There are also other problems with Mr. Heid's results, which I explain below.

Q. Would you characterize Mr. Heid's estimates as robust?

No. I found that the Company's Zero Intercept model parameter estimates are not robust because they change dramatically in response to small changes in the sample size. I checked the robustness of Mr. Heid's parameter estimates by successively adding one, two, and three observations to his Zero Intercept study. The results of ELN 1 are summarized graphically in figure 1. The horizontal axis in figure 1 shows the number of observations in each sensitivity performed in ELN-1. The green horizontal lines represent the zero-intercept estimates and the vertical grey bars represent the 95 percent confidence bounds of that estimate.

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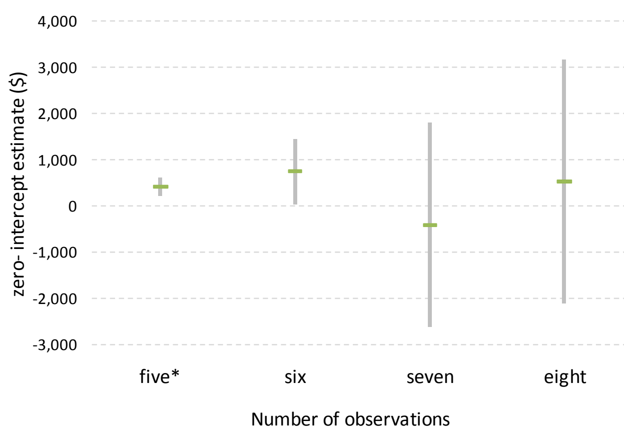
[8] The underlying theory behind the OLS estimators assumes that the regression is being estimated on a sufficiently large sample. Without a sample size of at least 30, and likely more, it is impossible to properly evaluate the results of an OLS regression.

Figure 1: Graph of Sensitivity Analysis ELN-1

Zero Intercept Estimate and Confidence Bounds



*K. Heid Zero Intercept study

Figure 1 and Schedule ELN-1 show that the zero-intercept estimate changes and the confidence bounds increase as more observations are added to the OLS regression that underlies the Zero Intercept model.

Q. How did you construct your sensitivity analysis?

A. Mr. Heid's workpapers for his Zero Intercept study contained eight observations, each associated with a different range of single-phase transformer sizes. However, Mr. Heid only included five of these eight observations in his study. ELN-1 successively adds the three observations that Mr. Heid excluded. The first column of ELN-1 reproduces the Company's Zero Intercept study. Note that the confidence bound for Mr. Heid's zero-intercept estimate is [$206.61 , $593.62]. That means that even if we accept Mr. Heid's zero-intercept estimate, we can only say that it likely falls between $206.61 and $593.62. If six observations (single-phase transformers smaller than 751 KVA) are included in the model, the zero-intercept estimate increases to $735.14, however, the standard error increases and the 95 percent confidence interval widens, ranging from $32 to $1,438. When seven observations (single-phase transformers smaller than 1,501 KVA) are included the zero-intercept estimate actually changes sign and equals -$411.78, with a 95 percent confidence interval ranging from -$2,631 to $1,808. Thus, by simply adding two additional observations, the key parameter of estimate of the model changes sign and becomes statistically insignificant. The negative estimate of the zero-intercept suggests a negative price for transformers with zero KVA which is a counterintuitive result.

If all of Mr. Heid's eight observations are included (single-phase transformers smaller than 2,001 KVA), the zero-intercept estimate changes to $510.17, but this estimate is statistically insignificant and the confidence interval ranges from -$2,132 to $3,152. The erratic behavior of the zero-intercept estimates in response to small changes in the sample size is likely a consequence of Mr. Heid's small sample size and the difference in cost across transformer sizes.

Q. Schedule ELN-1 shows that Mr. Heid's Zero-Intercept study has a higher R-squared statistic than the R-squared statistics of your sensitivity tests. Does that mean that Mr. Heid was correct in excluding the three observations that you consider?

A. No. The major problem with Mr. Heid's Zero Intercept study is the small sample size; he only used five observations. Estimating an OLS regression on five observations constitutes a misuse of the OLS model because the parameter estimates and diagnostics are only valid when the sample is sufficiently large, which generally means about 30 observations. In fact, all of the OLS parameter estimates in ELN1 are suspect because they are based on samples that are too small to allow for the distillation of meaningful information. However, ELN-1 shows that in addition to small sample problems, Mr. Heid's results lack robustness. It does not matter that the R-squared statistic in the Company's study is higher than the R-squared statistics of the sensitivities shown in ELN-1 because this does not change the fact that the Company's zero-intercept parameter is based on an insufficient sample size and lacks the critically important statistical property of robustness.

Q. What can we conclude from your sensitivity analysis?

A. My analysis in ELN-1 shows that the results of Mr. Heid's Zero Intercept study are not robust. By successively adding just three more of Mr. Heid's own observations, I found that his results changed drastically. I make no claims that the parameter estimates presented in ELN-1 themselves are valid because they too are based on an insufficient sample size. However, ELN-1 highlights statistical problems with the Company's Zero Intercept study by demonstrating that the results do not stand up to minor changes in the sample size. Given its lack of robustness, the Company's Zero Intercept study should not be relied upon in this proceeding.

Q. Did Mr. Heid properly assess the diagnostics of his Zero Intercept parameter estimates?

A. I do not believe he did. The OUCC asked the Company for standard diagnostics of the Zero Intercept model estimates (standard errors, t-statistics, and 95 percent confidence bounds) in OUCC Data Request 10-Q7. The Company did not provide them but stated in its response that the diagnostics could be calculated in Excel.[9] Given that Mr. Heid did not provide these diagnostics in his workpapers or in response to OUCC data requests, it appears that Mr. Heid did not examine or rely upon the standard errors, t-statistics, or 95 percent confidence intervals of his OLS parameter estimates when evaluating his results.

[9] *See* Vectren South's March 5, 2010 response to OUCC DR-10 Q-7.

Q. Aside from the statistical problems, are there other problems with the Company's Zero Intercept model?

A. Yes. Mr. Heid applied his Zero Intercept study results to transformers and capacitors that were not included in the original study; the transformer size variable is crudely estimated; and the data have peculiarities, including a negative quantity for three-phase transformers and unknown transformer vintage.

Q. Does Mr. Heid know the size of each of the transformers on which he bases his Zero Intercept study?

A. No. The transformer cost data that Mr. Heid used to create his five observations only indicate a size category for groups of transformers. These categories were presumably dictated by the Company's accounting methods. Mr. Heid simply assumed that all transformers in each size category had a KVA size equal to the mean of the boundaries of that category. Mr. Heid's transformer size assumptions are reproduced in table 2 below. For example, the Company's Zero Intercept study assumes that all of the 32,856 transformers between 20 and 50 KVA were 35 KVA.

Table 2: Transformer Size Assumptions of Vectren South's Zero Intercept Study

Transformer size Category	Number of transformers	Assumed size of transformers
3 - 19 KVA	11,047	11
20 - 50 KVA	32,856	35
51-150 KVA	2,538	100.5
151-200 KVA	511	175.5
201-350 KVA	68	275.5

Source: Kerry A. Heid's workpapers, MSFR15ab, p. 90.

However, it could be the case that all 32,856 transformers are 20 KVA, which makes Mr. Heid's assumption that all transformers are 35 KVA incorrect. We simply don't know the distribution of transformers within each size category.

Mr. Heid was forced to make this assumption because he didn't have more detailed size and cost information about the individual transformers. However, this suggests that he didn't have sufficient transformer data to perform a Zero Intercept study to begin with. Ideally, the cost data would have multiple observations for individual transformers and their actual size rather than aggregated data by size category. The quality of the OLS regression estimates are only as good as the data used to estimate them. If the sample data are incorrect or crudely estimated it is unlikely that the OLS parameter estimates themselves will be reasonable.

Q. Assuming Mr. Heid's Zero Intercept results were valid, was it applied appropriately?

A. No. Mr. Heid based his Zero Intercept study on five summary statistics based on 47,020 single-phase transformers that were smaller than 351 KVA. However, he applied the results to all of Vectren South's 55,487 line transformers and capacitors, despite the fact that some of the transformers were larger than 1,500 KVA and others were three-phase rather than single-phase. (See MSFR 15ab page 89). Mr. Heid provided no support for his decision to estimate the Zero Intercept model on a subset of transformers and apply the results to all transformers and capacitors.

Furthermore, The NARUC Manual states that the Zero Intercept model should only be applied to single-phase transformers that are less than or equal to 50 KVA while Mr. Heid uses single-phase line transformers up to 350 KVA.[10]

Q. Were there any other problems with the data?

A. Yes. The transformer cost data provided by Vectren South does not contain any information about transformer vintage. I assume that all 55,487 transformers and

[10] "Electric Utility Cost Allocation Manual," National Association of Regulatory Utility Commissioners, January 1992, p. 94.

capacitors were not purchased in a single year, which means that the price data are expressed in nominal dollars from different years. When asked in OUCC Data Request 10 Q-3, Vectren South was not able provide transformer vintages so I cannot assess the effects of this problem. Additionally, the total number of transformers and capacitors is based on a sum that includes the various transformer size and phase categories as well as 1,658 capacitors. Curiously, the subtotal for three-phase transformers is -282 because the quantity of three-phase transformers in the 3-19 KVA range is -2,382 (i.e., a negative number of transformers). Presumably, this number corresponds to retirements but the rest of the three-phase transformers sum to 2,100. As such, the transformer cost data appear to have multiple issues that cast serious doubt on their accuracy and usefulness in a Zero Intercept study.

Q. Please summarize the results of your analysis and findings.

A. I find that Mr. Heid's Zero Intercept study should not be relied upon in this proceeding because it suffers from multiple flaws, including the insufficient sample size, the zero-intercept estimate's lack of robustness, a crudely estimated transformer-size variable, and underlying transformer cost data issues.

Q. Does this conclude your testimony?

A. Yes, it does.

QUALIFICATIONS OF

EMMA L. NICHOLSON, PH.D.

EMMA L. NICHOLSON

Dr. Nicholson is a senior economist at Exeter Associates, Inc. with over six years experience in the energy industry. At Exeter, Dr. Nicholson's work entails modeling the economic impacts of proposed pricing mechanisms, market rule changes, and new infrastructure in electric power systems. She also specializes in the operation and design of energy markets, evaluates alternative energy supply options for large retail customers, conducts econometric forecasts of energy requirements and peak demand, and prepares statistical analyses of energy market data.

Education:

B.A. Economics and Political Science, University of Maryland College Park, May 2001

M.A. Economics, Georgetown University, December 2004

Ph.D. Economics, Georgetown University, August 2008.
Dissertation: "Essays on Restructured Electricity Markets."
Fields: industrial organization and microeconomic theory.

Previous Employment:

2008-2009 Senior Consultant, Energy Practice
Bates White, LLC.
Washington, D.C.

2004-2006 Industry Economist (three summer internships)
Federal Energy Regulatory Commission
Washington, D.C.

2001-2003 Research Assistant
Exeter Associates, Inc.
Columbia, Maryland

Professional Work Experience:

Dr. Nicholson's work at Exeter Associates, Inc. is primarily related to energy market analysis, econometric forecasting, evaluation of alternative energy supply options, and power supply acquisition.

While with Bates White, Dr. Nicholson developed econometric models to analyze natural gas and electricity markets. She examined NYMEX trade data to support the testimony of a Bates White expert testifying on behalf of the Federal Energy Regulatory Commission's (FERC) Office of Enforcement. Dr. Nicholson processed and created a database of natural gas trades and used an econometric model to investigate whether a particular trader manipulated the natural gas futures market. Dr. Nicholson also created 20-year forecasts of electric generation capacity, hourly load and fuel costs (natural gas, coal and oil) for a load flow model used to estimate the economic and environmental impacts of a proposed 1,200 MW DC transmission line in New York. She estimated the market price of electricity in the Southeastern U.S. by calculating the historical elasticity of supply. She also examined natural gas supply forecasts in Western Canada and conducted a depreciation study to support testimony submitted in a natural gas pipeline rate case before the FERC.

Dr. Nicholson worked at the Federal Energy Regulatory Commission in the summers of 2004, 2005, and 2006. She interned at the Office of Administrative Litigation in 2004 and 2005 where she participated as a member of FERC staff in crafting a position about a proposed natural gas interconnection in south Louisiana. She also investigated the merits of a proposed transmission adder and examined the implications of PJM's Three-Pivotal Supplier Test. Dr. Nicholson worked in the Office of Energy Markets and Rates, Central Division, in 2006 where she investigated a complaint about a retroactive price change in the Midwest ISO. She also examined the effects of a proposed Midwest ISO rule change that would charge virtual bidders uplift.

Dr. Nicholson began her professional career as a Research Assistant at Exeter Associates, where she developed the econometric models used to generate a ten-year forecast of electricity consumption and peak demand in the state of Maryland. She built various econometric and Excel-based models to estimate the financial impacts of proposed rate changes associated with various utility rate case proceedings. She also prepared a monthly memo for the Department of Energy (Headquarters) that summarized regulatory activities and general electricity market conditions in eleven states.

<u>Publications and Consulting Reports:</u>

"Abandon all Hope? FERC's Evolving Standards for Identifying Comparable Firms and Estimating the Rate of Return," with Jonathan Lesser, *The Energy Law Journal*. April 2009. Vol 30:105; pp. 105-132.

"Forecasted Electric Energy Consumption and Peak Demands for Maryland." Exeter Associates, Inc., 2002. (Prepared for the Maryland Department of Natural Resources, Power Plant Research Program.)

<u>Participation in Conferences, Seminars and Workshops</u>:

2006 and 2007 Midwestern Economic Association Meetings, presenter and discussant.

Peer reviewer for the Journal of Environmental Economics and Management. (2009 through present.)

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SCHEDULE ACCOMPANYING THE

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JUNE 25, 2010

EXETER

ASSOCIATES, INC.
10480 Little Patuxent Parkway
Suite 300
Columbia, Maryland 21044

Sensitivity Analysis of Vectren South's Zero Intercept Study

	Single-Phase Transformer Sizes Included in Regression			
	3-350 KVA (Heid Study)	**3-750 KVA**	**3-1,500 KVA**	**3 KVA and above**
Number of observations	n = 5	n = 6	n = 7	n = 8
Constant/zero-intercept estimate	400.11	735.14	-411.79	510.17
- Standard Error	60.80	253.16	863.39	1079.82
- t-statistic	6.58	2.90	-0.48	0.47
- 95% confidence bounds	[206.61 , 593.62]	[32.26 , 1438.02]	[-2631.21 , 1807.63]	[-2132.05 , 3152.38]
- Statistically significant at 5%?	Yes	Yes	No	No
β estimate	10.46	7.03	14.41	10.63
- Standard error	0.40	0.96	1.76	1.28
- t-statistic	26.44	7.36	8.20	8.30
- 95% confidence bounds	[9.20 , 11.72]	[4.38 , 9.68]	[9.89 , 18.93]	[7.50 , 13.77]
- Statistically significant at 5%?	Yes	Yes	Yes	Yes
R-squared	0.996	.931	.931	.907

VERIFICATION

STATE OF MARYLAND)
) ss:
COUNTY OF HOWARD)

The undersigned, Emma L. Nicholson, under penalties of perjury and being first duly sworn on his oath, says that she is a Senior Economist at Exeter Associates, Inc., a Consultant for the Indiana Office of Utility Consumer Counselor; and in the matter of Cause No. 43839 that she caused to be prepared and read the foregoing that the representations set forth therein are true and correct to the best of her knowledge, information and belief.

Dated: 23 JUNE 2010

By: Emma L Nicholson

Subscribed and sworn to before me, a Notary Public, this 23 day of June 2010.

Deborah M Adams
Signature

Deborah M Adams
Printed Name

My Commission Expires: 2/2011

My County of Residence: PG